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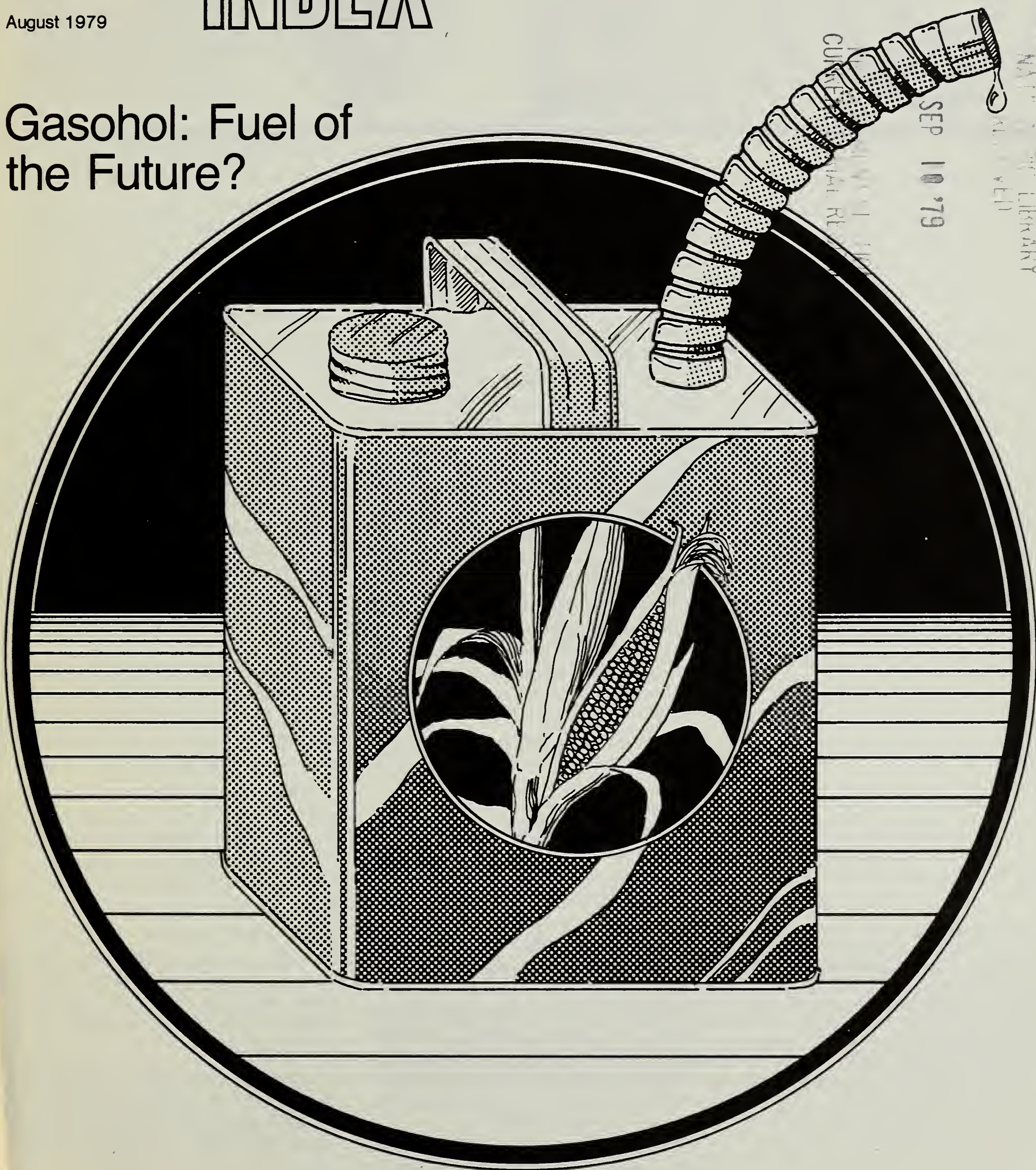
FARM INDEX

Gasohol: Fuel of the Future?



Outlook

Retail food prices have risen more than expected just about every month. During the winter, it was because weather and labor disputes disrupted production of meats, fruits, and vegetables. Now it's higher costs for energy that threaten to put more upward pressure on food prices this summer.

Moderation expected. USDA economists still figure that from here on in, food price increases will be more modest than during the early part of the year.

Higher meat prices have been the major contributor to food price increases in recent months. Although supplies of beef are down from last year, there is more pork and poultry meat available, and total meat supplies this year are expected to be near the record level of 1977.

Yet, despite the large meat supplies, prices have increased much faster than the rate of inflation in the general economy.

Beef prices continue high. Retail beef prices in particular have been stronger than expected. The first quarter strength in the general economy generated strong demand. Added to that, beef supplies were shrinking as fewer animals went to slaughter, partly because producers were rebuilding the cattle herd.

Typically, marketing spreads narrow when farm prices go up. But just the opposite has happened recently. During the latter part of 1978 and early 1979, price spreads increased even as farm prices went up. And spreads have continued to widen in recent months, despite price declines at the farm level.

Final estimates for May indicate that, even though the farm value of Choice beef fell about 2 percent, the farm-to-retail spread rose 13 percent.

Moreover, marketing spreads, particularly for beef and pork, are increasing more than apparent increases in marketing costs. As a consequence, recent declines in livestock prices—which economists consider crucial to a slowing of food price rises—have not been passed on to consumers.

Forecast for the year. Inflation in the general economy is expected to continue at about the current 10-percent rate, generally influencing marketing costs more than expected earlier. Labor contract settlements will result in larger total labor costs than had been previously assumed, and high energy costs will increase both production and distribution costs.

However, the economy is slowing as expected, and moderating consumer demand could lessen upward pressure on prices during the remainder of the year.

However, given the increases we've already had and the uncertainties which remain, it is likely that the average increase in food prices in 1979 will moderately exceed 10 percent.

The final outcome will depend heavily on whether marketing spreads, particularly for beef and pork, continue to increase faster than cost conditions in the meat industry warrant.

Other uncertainties include the impact of the energy situation and whether farm prices, especially grain prices, stabilize for the rest of the year.

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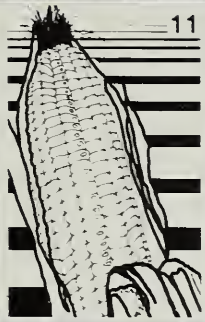

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Departments

Martha Newton, Editor

Barry Murray, Geraldine Schumacher, Daniel R. Williamson, Contributing Editors; Jonathan Kirk, Art Director

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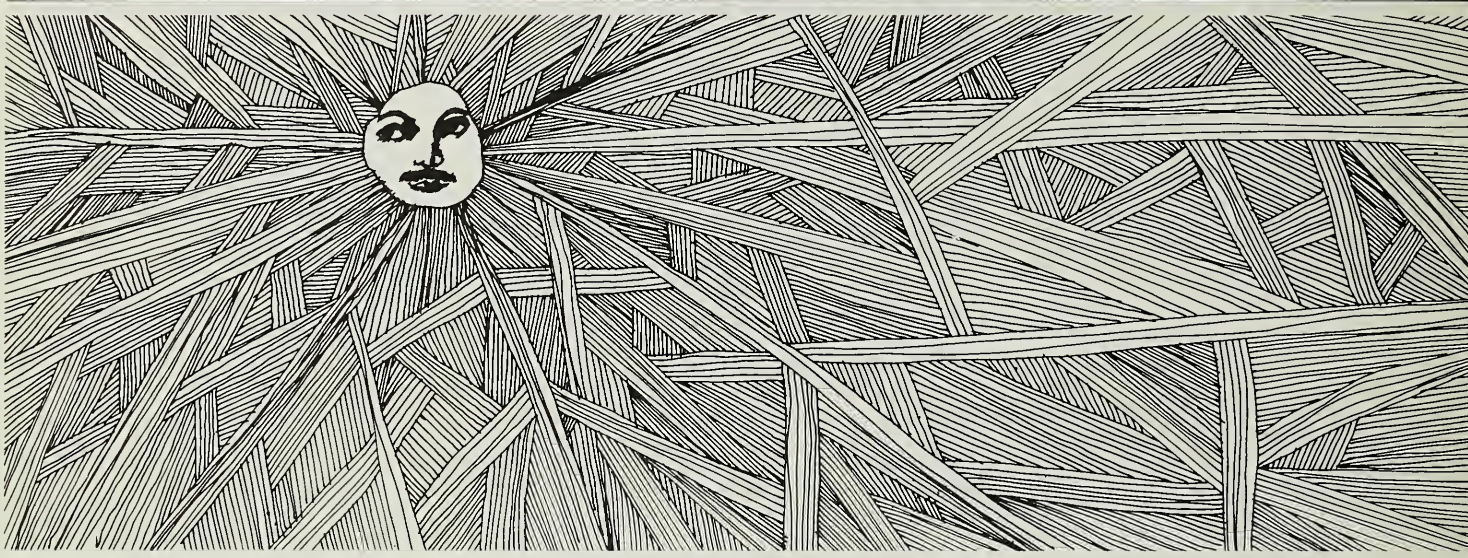
Harnessing the Sun's Energy



Long lines at the gas pumps have once again focused the Nation's attention on developing alternative energy sources. And one of the sources being examined closely is the sun.

The sun is the world's most abundant and permanent source of energy. The equivalent of all the energy required in U.S. agricultural production each year falls as sunshine on an area 10 miles square.

On a broader scale, the equivalent of all our country's energy requirements projected for 1985 falls as sunshine on an area 80 miles square. This is less than two-tenths of 1 percent of the total U.S. land area.

But despite its abundant supply, solary energy has a number of disadvantages when compared with conventional energy sources. Namely, it's difficult to handle, transport, and store.

Another look

Nevertheless, the rapidly increasing costs of energy, the temporary disruptions of supply, a potential long-term shortage, and the needs to reduce our dependence on foreign oil and improve our balance of payments have caused USDA and others to take another look at harnessing the sun's vast power.

One recent program, administered by USDA in cooperation with the U.S. Department of Energy (DOE) and a number of public and private research institutions, studied the feasibility of using solar energy in agricultural production.

Study results

Examined were drying grain and other crops, heating and cooling greenhouses and rural residences, heating livestock shelters, and food processing.

Here's a rundown of the results:

Grain drying. Grain drying is an energy-intensive farm operation that will be increasingly affected by diminishing supplies and escalating prices of fossil fuels.

An estimated 65–70 percent of our corn crop is now mechanically dried and the figure could reach 80 percent by next year.

In addition, all the rice and 10–20 percent of the soybeans and grain sorghum receive some mechanical drying at the farm or commercial elevator level.

LP gas is the principal fuel used, although some natural gas and electricity are also consumed.

A USDA study examined the economic feasibility of eight different solar grain drying systems. Estimates for the lowest cost solar systems show them to be as low as or lower than the costs for some conventional grain dryers.

However, researchers note that a comparison of solar and conventional grain drying costs must take into account the fact that conventional methods are highly dependable, while solar systems are susceptible to the weather—when solar energy is needed most it is available least.

Total reliance on the sun's energy will likely be limited to a solar grain drying belt, and even then a backup system using conventional fuels will probably be required.

Drying other crops. The curing and drying of such other crops as tobacco, peanuts, and alfalfa also consumes large quantities of fossil fuels—an equivalent of about 530 million gallons of LP gas annually. Prospects appear good that part of this energy requirement can be supplied by the sun.

Several solar energy systems are being evaluated for tobacco curing (among crops that are dried, tobacco is second only to corn in the quantity of fuel used).

One of these is a greenhouse bulk curing barn which can be used for tobacco curing during the summer months and to grow greenhouse crops and tobacco transplants the remainder of the year.

The solar heat generated by this system's "greenhouse effect" supplies 30-40 percent of the heat required in the curing process.

And since the cost of the complete prototype structure and auxiliary equipment is about the same—on an equivalent capacity basis—as a conventional bulk curing barn (according to the developers), the 30-40 percent savings in fuel would represent a net savings in curing costs.

In the area of peanut curing—virtually all peanuts receive some artificial drying—the emphasis has been to develop multiuse solar systems which can also be used to cure tobacco and dry grain.

Heating and cooling greenhouses and rural residences. Greenhouse horticulture—used for the production of florist, nursery, and certain vegetable crops—is an energy-intensive industry which consumes an equivalent of nearly 600 million gallons of LP gas each year.

The possibility of fuel shortages is a major concern to growers, mostly small independent producers. Lack of fuel for just a few hours at a crucial time can completely destroy a season's production.

Although there have been no specific economic studies, the USDA-DOE program has tested such solar systems as greenhouse-residence combinations, and projects involving collector design, mathematical models, and heat storage, transfer, and distribution. At this time, there are not enough data in to evaluate the projects.

Heating livestock shelters. Heating animal shelters—those used for poultry brooding, swine farrowing, and dairy milking—appears to be one of the more promising uses of solar energy.

More than 70 percent of the energy used in poultry production is for brooding. Supplemental heat is especially critical during the first 2-3 weeks of a baby chick's life, and industry leaders have been quick to recognize that they are extremely vulnerable to energy shortages and rising costs.

LP gas is the primary fuel used for brooding, although some fuel oil, natural gas, electricity, and coal are also used.

There is substantial work underway at a number of locations to design and evaluate solar energy systems which can economically supply a part of this energy requirement. For the most part, roof-mounted flat-plate collector systems utilizing either heated water or air are being studied.

As with baby chicks, supplemental heat is essential during the early stages of a young pig's life. Thus, the main use being considered for solar energy in swine production is to provide heat for farrowing and nursery buildings.

Besides research on conventional flat-plate collectors, several alternate designs are being studied.

Whereas thermal energy requirements for poultry and swine production vary with the age of the animal and with the season, a year-around supply is necessary in the dairy industry, with much of it going to the milking operation.

Experiments using solar energy for water and space heating in the milking parlor are being conducted under the USDA-DOE program.

Researchers estimate that the average dairy farm could be converted to solar heat for $4,500 or less, providing the farmer does much of the installation himself. The initial cost could be recovered in fuel savings in about 5-10 years.

Major advantages of applying solar energy to a dairy operation are that its energy requirements are fairly evenly distributed throughout the year and the facility is in continuous use.

In most other agricultural enterprises, both livestock and crop curing or drying, use of the facility is highly seasonal, thus greatly increasing the investment cost per unit of solar energy used.

While there has been much progress in using the sun's power to heat livestock shelters, several economic studies indicate that solar energy is still several years away from being economically competitive with conventional fuels in this area.

Food processing. Food processing consumes about 5 percent of all

energy used in this country each year. Researchers believe that the sun's power could supply a part of this requirement in the future.

The use of thermal energy from the sun to dry and preserve food is nothing new. In fact, it is one of the earliest methods of food processing. It is still widely used in many parts of the world to dry raisins, fruit, coffee, cocoa, fish, and a host of other products.

Under the USDA-DOE program, solar energy systems to supply part of the hot water needs of meat, milk, fruit, and vegetable processing plants are being studied. Other systems are concerned with drying and dehydrating various fruits, vegetables, potatoes, and processing plant byproducts.

Preliminary findings indicate that among food processing plants, fruit and vegetable have the least potential for use of solar water heating because of their seasonal energy demands.

Dairy and meat processing plants are more promising because they have year-around hot water demands compatible with a solar water heating system.

The results also show that solar water heating in food processing requires a payback period of around 20 years. Potential energy savings are limited to 20-50 percent, depending on the type of plant, the annual demand schedule, the water temperature required, the cost of conventional energy, and the payback period required.

As for using the sun to dry and dehydrate foods, the studies suggest that fruits and vegetables dried by direct application of solar energy compare favorably in physical properties and flavor with conventionally dried products.

Reflectors are useful in intensifying solar radiation and helping to increase drying rates.

By the same token, the temperature capabilities of flat-plate solar collectors are compatible with potato drying requirements, but the temperature is too low to operate a spray dryer at full capacity.

It is better to use solar energy to preheat drying air, then use conventional fuels to boost temperatures to the full-capacity level.

Solar energy and irrigation

Although not included in this particular USDA-DOE study, the use of solar energy for pumping irrigation water is also being examined.

Irrigation is agriculture's third biggest energy user—after field machinery and transportation. According to the latest Census of Agriculture, there were about 52 million irrigated acres in 1974. Of this, 68 percent required on-farm pumping of irrigation water.

Electricity and natural gas provide about three-fourths of the power for irrigation pumping, with diesel, LP gas, and gasoline furnishing the rest.

Two systems

Several pilot studies are evaluating the technical and economic feasiblity of solar energy for irrigation. Two distinct systems are being considered:

- Concentrating solar collectors to convert the sun's energy to mechanical power.
- Utilizing solar cells for direct conversion of the sun's energy to electricity.

One study concludes that solar energy for irrigation purposes will become economically viable in the early to middle 1980's.

So what does all this mean for the future of U.S. agricultural production? Will solar energy save the day for farmers faced with shortages in supplies and escalating costs of fossil fuels?

Limited use

Unfortunately, many researchers believe that the overall impact of solar energy use in agriculture will probably be rather limited. Dramatic technical breakthroughs to lower costs are not foreseen.

Also, the amount of fuel used in agricultural applications where solar energy can reduce consumption—less than 1 percent of total U.S. energy consumption—is somewhat small compared with the amounts needed for cars and other uses.

However, in those particular areas where solar energy can contribute, realized benefits could be substantial and would contribute to the viability of the greenhouse industry, or other agricultural segments.

It is for this reason that an assessment of solar energy is important and needed. It will point out just what part the many small uses of this energy source might play in sustaining and strengthening the overall economic structure of agriculture.

[Based on the manuscript, "A Review of Research on Solar Energy Use in Agriculture," by W.K. Trotter, Athens, Ga., W.G. Heid, Jr., Manhattan, Kan., and R.G. McElroy, all with the National Economics Division.]

Quenching Agriculture's Thirst

Quenching the thirst of irrigated agriculture has long aggravated Western farmers.

And now that they're faced with increasing energy costs, irrigation will become an even bigger problem.

Many Federal water and energy conservation programs are focusing on irrigated agriculture, since it accounts for nearly 80 percent of all water consumed in the U.S. and 20 percent of all energy used in agriculture.

Because of the high cost of energy to run irrigation systems, farmers are looking for ways to cut water use.

Irrigation efficiency

The amount of water that can be saved and the potential for improvement in irrigation efficiency—the ratio of the water stored in the root zone that is used by a crop to the total volume of water delivered to a farm—varies by region and the irrigation situation within the region.

Potential water savings also depend on the crop, the type and location of the land, and the irrigation system.

Irrigation efficiency can be improved in almost all areas, but it is not feasible for all areas to use the same technology or reasonable to expect the same results from a technology.

System selection, in turn, depends on the water source, soil type, lay of the land, size and shape of the tract, the energy source, and the cost and availability of other inputs, such as labor.

Irrigation Development

Over the years, the development of irrigation in an area has reflected water availability, energy costs, water law, the types of crops, and the supply and cost of labor. These frequently changing factors, unfortunately, have left many farmers with inefficient irrigation systems.

In some cases this has wasted water on the originating farm, while a nearby neighbor has benefited from the runoff. The situation may imply a relatively high regional water-use efficiency. However, the secondary user ends up with low-quality water because of the chemicals and other materials picked up by the water during its first application.

Methods to improve

Improved irrigation water scheduling, better pump and power plant maintenance, irrigation system modification to reduce pressure or water requirements, or irrigation system replacement are measures being considered and adopted by irrigation farmers.

However, the economics of a farmer's decision may lead to some surprising results. For example, studies of farming in Nebraska indicate that a 100 percent increase in 1977 energy costs could be offset by approximately a $.30 per bushel increase in the price of corn.

Considering this relationship, irrigation farmers with some exceptions should not be expected to rapidly change their irrigation practices. Farmers may benefit by continuing irrigation until a major replacement investment is required.

The reason: During the interval, the return on investment in irrigation equipment, although inadequate to cover all costs, is greater than the return attainable without irrigation.

No quick change

Thus, even as energy prices skyrocket, an immediate large reduction in irrigated agriculture should not be expected. However, over time, irrigators may make major adjustments.

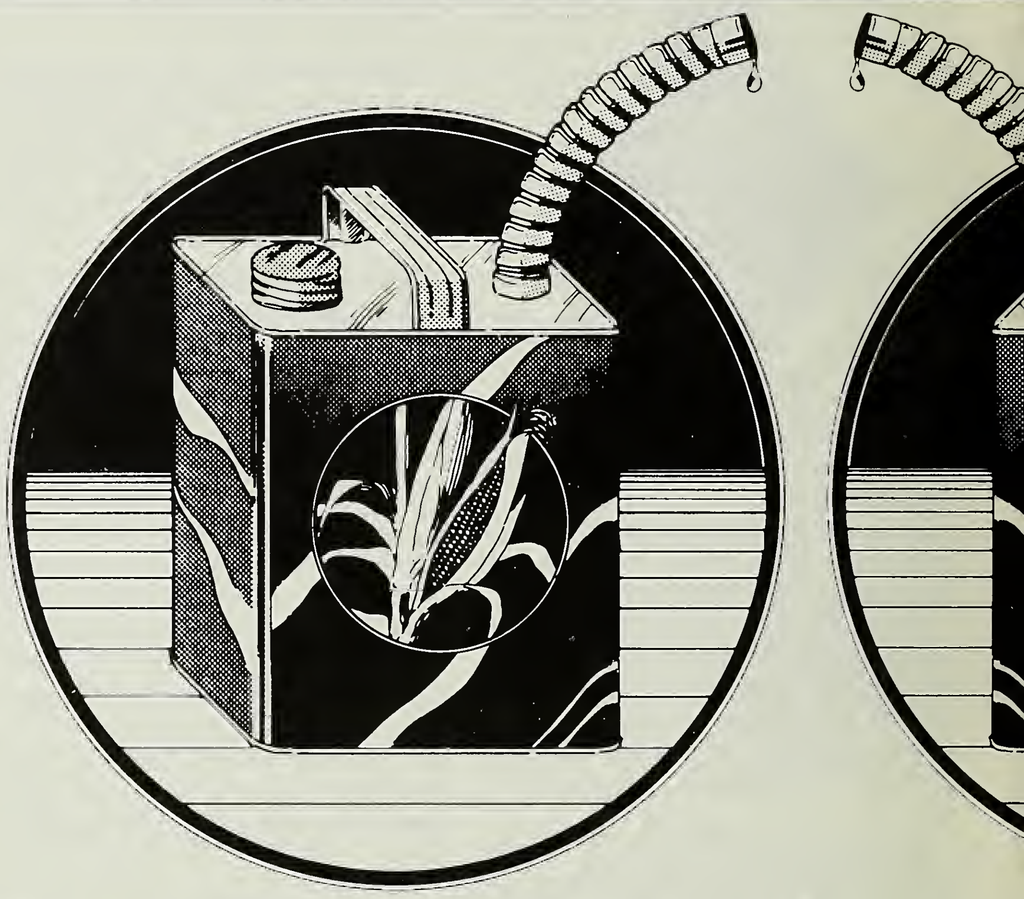
Major adjustments would also be expected if irrigation fuel supplies were cut. A reduction in the quantity of fuel available could only be offset by energy conservation measures or discontinuation of irrigation.

A cutback in irrigation water could have a proportional impact on the farm sector, since over 40 million acres—or nearly 12 percent—of farmland is irrigated. Irrigation is particularly important for some crops, such as orchard and vegetable crops.

Irrigation is concentrated in the 17 Western States which have around 90 percent of all irrigated farmland. Over 80 percent of the crops produced in California, Arizona, New Mexico, Nevada, Utah, Wyoming, and Idaho come from irrigated land.

[Based on the manuscript, "Irrigation Water Management in an Energy Short Economy," by Melvin Cotner, Washington, D.C., Verel W. Benson and Norman E. Landgren, Lincoln, Nebr., all with the Natural Resource Economics Division.]

Gasohol: Fuel of the Future?



It's too early to start gauging your car's "miles per bushel," but recent rises in oil prices and rapidly spreading gas shortages have driven USDA to take another look at gasohol.

Last year USDA issued a report which concluded that the economics for mass production of gasohol—the mixture of 90 percent unleaded gasoline and 10 percent ethyl alcohol (ethanol), a liquid derived from distilling grains and various other agricultural commodities—could not be justified.

Everyone agreed that gasohol could solve two big problems—it could lessen our dependence on foreign oil while putting to good use this country's oversupply of grain. But economists felt that gasohol's disadvantages far outweighted its advantages.

Major obstacles

The major obstacles, at that time, to a gasohol program were that after production, gasohol would cost considerably more at the pump than gasoline, and the amount of petroleum-based fuel needed to produce ethanol exceeded the amount of energy provided by the final product.

Since these findings were announced, they have met with much criticism. Critics of the report say many of the arguments against gasohol were based on obsolete data or limited economic analysis.

Fueled by these charges and an increase in gasoline prices during the last year, USDA has taken another look, with a positive perspective, at the feasibility of the alcohol fuel issue.

Reflecting Congressional interests, USDA has made tentative commitments of $42.7 million in loan guarantees to assist in financing four pilot projects to convert agricultural and forest products into gasohol.

USDA research and development

Also, the Department is expanding its research and development work on alcohol fuels. For fiscal year 1980, $6 million has been earmarked for this work.

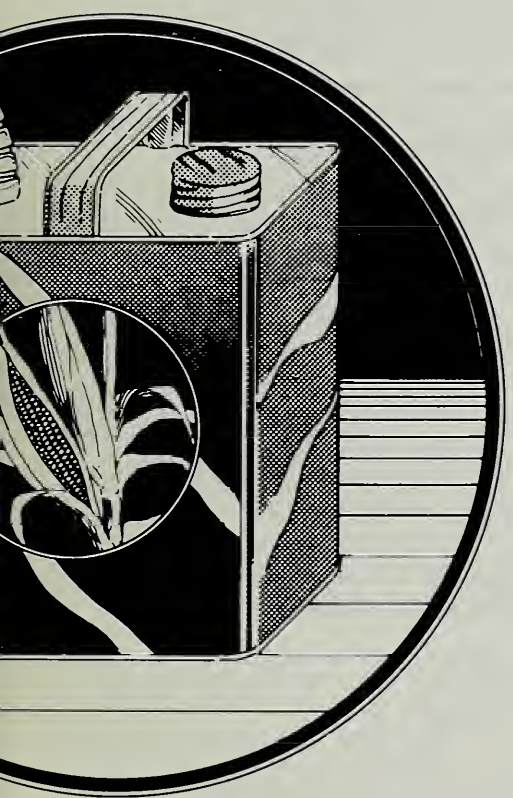
The media have also jumped on the gasohol bandwagon. Newspapers, magazines, and radio and TV stations are flooding the public nationwide with gasohol stories, pro and con.

Hundreds of gas stations in the Midwest have begun pumping the fuel. Nationwide, even more stations are expected to offer gasohol in wake of the recent decision by the Environmental Protection Agency not to impede substitution of gasohol for unleaded gas.

Consumer acceptance of the fuel has been promising. Boosters of the product claim alcohol added to unleaded gas increases mileage and octane, while reducing engine knock and pollutant emissions.

No significant difference

However, other studies have concluded that gasohol does not differ



significantly from straight gasoline in respect to mileage.

A survey conducted by the Iowa Development Commission reports that 73 percent of 1,463 people polled who have tried gasohol would use the fuel regularly.

An early drawback to widespread use of gasohol was its price. However, price per gallon for the fuel may become more competitive as crude oil prices rise.

Fuel grade alcohol itself sells for around $1.60 a gallon, but the 9-to-1 ratio spreads the total cost.

Gasohol still sells at the pump for somewhat more than gasoline, although the Federal Government has enacted a 4-cents-per-gallon excise tax exemption, which is equivalent to a 40-cents-per-gallon subsidy on the cost of the alcohol.

Sales tax waived

In Iowa and Nebraska, the State sales tax on gasohol has been waived, making the price comparable to unleaded gasoline. Also, many other States are considering bills to reduce or eliminate taxes on gasohol sales.

One service station in the Washington, D.C. metropolitan area sold regular gas at 84.9 cents a gallon in early June, no-lead at 88.9 a gallon, and gasohol at 93.9 a gallon.

Widespread usage of gasohol could have a significant effect on the U.S. farmer, depending on the size of the program.

A national gasohol program, one that would cover total gasoline consumption in the U.S., would call for a sharp increase in grain production to meet both fuel and energy needs. It would take over half of the Nation's corn crop to produce the needed 10.8 billion gallons of alcohol to make the 10-percent blend.

Preference for corn

In most gasohol programs now in existence, corn has been chosen as the alcohol-producing grain because of its high starch content, ease in processing, abundance, and lower price compared with wheat.

In late June a bushel of corn was selling for over a dollar less than a bushel of wheat.

Corn produces 2.6 gallons of alcohol per bushel, leaving distillers dried grains—a high-protein animal feed—as a major byproduct.

If corn were used as the major alcohol raw material to fill the needs of a national gasohol program and assure an ample supply of grain to food and feed markets, idle land would be forced into production. Also, land from other crops, such as wheat and soybeans, would have to be diverted.

Corn controversy

There is much controversy over the effects this might have on the American economy.

Many observers are certain that any considerable amount of corn used for production of alcohol will result in higher food prices, including cereals, baked goods, and red meats.

There is a fear that the consumer might just be swapping one problem for another. He would have enough fuel at the expense of higher food prices.

In light of the economic risks involved with alcohol from corn, USDA has recommended that gasohol be produced mainly from agricultural wastes—corn stalks, wheat straw, wood chips, and garbage.

A primary purpose for implementing an alcohol fuel program would be energy-efficiency. This means production of ethanol alcohol from grains or agricultural wastes yielding more energy that its uses.

Program pitfall

Many feel it would not be sensible to initiate a large-scale Government-supported program for the conversion of agricultural products to ethanol unless it can be demonstrated that the program results in a significant net

gain in energy. This was also considered a pitfall to a national gasohol program.

Present-day alcohol distilleries use petroleum-based fuels or natural gas for alcohol production. They were not constructed to conserve fuel and were designed for the production of beverage-grade alcohol.

Research using these methods found that the grains-to-alcohol process consumed more energy than it yielded.

However, recent emphasis on maximizing energy savings have led to alcohol conversion methods that promise a positive net energy balance.

Coal: a wise choice

If a Government-supported program for the conversion of agricultural products to ethanol were initiated, it would be wise to require that coal be used for production energy. Unlike oil and natural gas, which are in limited supply, America's coal supply is ample to fulfill our needs for centuries to come.

Coal would not substantially increase manufacturing costs, provided distilleries are located in areas where coal shipment costs could be minimized.

Since the capital requirements for using coal would probably exceed those for oil or gas, a law requiring the use of coal would be necessary, because ethanol producers would probably prefer to pay somewhat higher energy bills than to raise additional start-up capital.

[Based on a statement by Secretary of Agriculture Bob Bergland before the House Committee on Science and Technology, May 4, 1979; a statement by Deputy Secretary of of Agriculture Jim Williams before the House Committee on Agriculture, May 15, 1979; and special material.]

Not a New Idea

In 1906, the first real effort to use a alcohol-gasoline blend as a motor fuel surfaced.

Farmers, facing agricultural price declines, and alcohol distillers joined forces to combat what appeared to be growing shortages of petroleum supplies.

But the price of alcohol was high compared to gasoline, partly because of the Federal tax placed on it. So fuel-alcohol proponents successfully petitioned Congress to have the Federal beverage alcohol tax removed from alcohol to be used as a motor fuel.

Just when it appeared that the movement was gaining momentum, huge amounts of oil were discovered in Oklahoma, killing the fuel-alcohol movement for the time being.

A few years later, during a period of high gasoline and unusually low alcohol prices, Standard Oil Co. of New Jersey marketed a 25 percent alcohol-gasoline blend in the Baltimore area.

Unfortunately, small amounts of water also were in the blend. The water caused the alcohol and gasoline to separate in gas tanks and carburetors. The alcohol worked as a solvent on sediment, clogging fuel lines and stalling cars.

But the movement did not die. By 1933, factions from the economically depressed farm sector once again viewed fuel-alcohol as a source of financial relief.

They pointed out that several foreign countries were using alcohol blends with success. This, coupled with a 1932 prediction by the Federal Oil Conservation Board that most known oil reserves would be depleted in 10 years, once more added fuel to the gasohol issue.

The oil companies lauched a fierce antialcohol campaign, and by the time the smoke had cleared, accused the alcohol-fuel supporters of such wrongs as attempting "to make every filling station and gasoline pump a potential speakeasy" and trying "to make alcoholics out of America's 22 million automobiles."

But the movement pressed on. In May 1935, a meeting of the First Dearborn Conference for the promotion of science, industry, and agriculture was hosted by Henry and Edsel Ford in Dearborn, Michigan.

Out of this organization came America's first fuel-alcohol plant in Atchison, Kansas.

By the late spring of the year 1938, the plant's alcohol-fuel, which was marketed under the name of "Agrol," was selling in 2,000 service stations in eight midwestern States.

But cost was a problem. The best the Atchison plant could do was produce alcohol at 25 cents per gallon, five times the average refinery price for gasoline.

Because the price of Agrol was never able to compete with gasoline, the Atchison plant was shut down in 1939.

[Based on the manuscript, "Resistance to Long-Term Energy Transition: The Case of Power Alcohol in the 1930's," by August Giebelhaus of the Georgia Institute of Technology.]

Amazing Maize

World feed grain exports—led by American corn—have doubled in the past decade because rising incomes have enabled people across most of the globe to upgrade their diets with more meat.

That global craving for meat enticed American farmers to produce 179.9 million tons of corn last year—49 percent of the total world harvest, and about a fourth of world feed grain production.

To the U.S. economy, that 1978 crop meant $5.26 billion on the plus side of the balance of trade as 25-30 percent of each year's is exported. In fact, corn accounted for a fifth of the total value of all agricultural exports that year.

Underpinning

Corn has become the underpinning of a world meat-feed grain boom that is expected to continue growing 2 to 3.5 percent annually through the 1980's as per capita incomes and demand for meat grow.

The 90 million tons of feed grains exported worldwide last year could reach 120 to 135 million tons by 1988, with corn comprising 83 to 97 million tons of this total.

A closer look at the global corn crop shows why American corn is so vital to the world feed grain situation.

About 80 percent of the world corn crop is used in countries where it is produced, and about 60 percent is used as a feed grain. About 20 percent moves into world trade, where most of it is used for livestock feed.

Incomes set pace

In the past 2 decades, demand for feed grains has closely followed rising incomes. Since many of the more affluent countries have limited capacity for producing feed grains, imports become increasingly necessary.

In Europe, imports grew by a million tons a year—a 5-percent annual growth. Between 1968-78, European feed grain production increased by about 38 million tons, while use increased 50 million tons.

Future European demand for feed grain imports should continue. The European Community (EC) now imports about 15 million tons of corn—about a fourth of world corn imports. By 1983, feed grain imports—two-thirds of which is corn—should be 26-28 million tons. By 1988, these imports should reach 29-32 million tons.

A global overview

Western European demand for feed grains is echoed across the globe:

- The Soviet Union, which has caused great fluctuations in world corn prices and trade levels in recent years through its sudden and massive imports, may ship in 15-20 million tons of corn by 1988 as the government upgrades the national diet with more meat.
- Eastern European nations are importing around 8 million tons of feed grains now—more than half of which is corn. By 1983, feed grain imports could reach 9-10 million tons, rising to 11-12 million by 1988. Corn will comprise the bulk of these imports.
- Asian corn imports tripled during 1964-78 as the region made great gains in affluence and population. Emerging industrial economies in East Asia, such as the Republic of Korea, Taiwan, and Hong Kong, produce insufficient feed grains to support demand, which should continue rising in the 1980's.
- Japanese corn imports could reach 14 million tons by 1988. The rate of increase is slower than in other parts of Asia, because the Japanese had better diets to begin with.
- China, with its vast potential, remains an uncertain market. It now imports only about 4 million tons of corn, but increases may come in the next decade, depending on Chinese policy.

• Middle Eastern oil producers showed great increases in corn imports in recent years as their standards of living increased. Domestic production is extremely limited, so the increasing demand for meat translates almost directly into feed grain imports—especially for corn. Corn imports there could hit 3 million tons in 1983, and rise to 4 million in 1988.

• African corn imports rose to 1.7 million tons last year, and could almost double by 1983 as the continent's population continues to rise faster than its food production.

• In the American hemisphere, imports could reach 5.5 million tons by 1983. Argentina and the U.S. should fill this market.

Major producers

To meet this rising worldwide demand for feed grains in the 1980's, importing nations must again turn to the major producers of the 1970's: the U.S., Argentina, South Africa, and Thailand.

The U.S. will dominate world corn trade in the coming decade—as it has historically.

During the past decade, growth in U.S. corn yields accounted for a greater proportion of production gains than did increased land use. During the past 2 decades, corn yields grew almost 2 percent annually due to technological gains.

Corn yields are expected to increase over the 5.8 tons per hectare average of 1976-78 to 7 tons per hectare during the 1980's because:

• An improved fertilizer-corn price ratio should lead farmers to apply more fertilizer.

• A backlog exists of unadopted corn production technology and improved management techniques which should come into use during the 1980's.

Yield gains expected

These improvements should sustain annual 2-percent yield gains at least through 1988. If so, U.S. corn output could top 190 million tons in 1983, and 200 million tons in 1988—if other factors, such as policy, weather, and the price of corn substitutes permit.

Domestic corn consumption grew an average of 1.6 percent annually between 1961-78, reaching 116 million tons last year—87 percent of which was used as feed. Use should reach 125 million tons in 1983, and 131 million tons in 1988.

Based on this consumption projection, the U.S. could export more than 70 million tons by 1988—a 25-million-ton increase.

Argentine potential

Argentina, with its vast land and favorable climate, could substantially increase corn production and exports. However, government policies since 1960 have tended to hamper production and exports.

Even with favorable government policies, corn production would be depressed by competition from more profitable crops, such as oilseeds. Thus, Argentine corn exports should hold to 6-7 million tons in 1983, and 7-8 million tons in 1988.

In Thailand, the promise of favorable government policies combined with ample land to be cultivated offers a prospect of growing exports of corn and sorghum through the 1980's.

In the past decade and a half, Thailand has increased its total area harvested by more than 10 percent annually. Another 3.5 million hectares of usable land remains untapped.

However, the low Thai yield rate of 2.2 tons per hectare last year—less than half the U.S. yield—shows only little promise of increasing, so production should reach 3.7 million tons in 1983, and 4.5 million tons in 1988.

Livestock demand

Growing demand for livestock products will also increase. Thus, exports will likely increase only slightly to the 2- to 3-million-ton level.

In South Africa, it's difficult to expand cultivated area; thus the corn harvest should grow about 3 percent annually in the 1980's, while domestic food demand slows to a 2.8-percent annual increase.

However, growing demand for livestock products may make up for the slower direct consumption gains. Thus, corn exports should hold steady or increase only slightly during the next decade, holding at about 3 million tons.

The total world feed grain production outlook for the 1980's indicates a great potential for increasing supplies of feed grain for export by 20-30 million tons of corn.

The U.S. alone could produce enough to export 63 million tons in 1983 and 73 million in 1988—an increase of 13 to 23 million tons. Argentina and Thailand could boost corn exports by 1-3 million tons each if yield increase potentials are realized.

[Based on the manuscript, "Trade in World Corn: Trends and Prospects for the 1980's," by Richard F. Nehring, International Economics Division.]

Sunflowers: Up and Coming Oilseed

Despite a 75-percent increase in prospective acreage this year, sunflowers are not a contender for the top oilseed spot yet. But soybeans, which are No. 1, will face some stiff competition in the years ahead.

In fact, the time may come when the two will split the market honors—with sunflowers taking over as the premier oil crop and soybeans serving as the protein crop.

Although the sunflower is native to the Americas, sustained production of oilseed varieties began in the U.S. only 13 years ago. Since then, acreage has soared.

Plantings last year totaled over 3 million acres—more than the area planted to such oilseed crops as peanuts or safflowers, or to grains such as rice or rye. The 75-percent increase in acreage planned for this year would push the sunflower total more than 5 million acres.

Leading producers

The big sunflower States currently are North and South Dakota, Minnesota, and Texas. In the northern production area, the acreage gains have come at the expense of flax, wheat, barley, and other small grains.

In the future, the crop may gain ground in other areas, too, especially on the fringes of soybean, corn, and cotton areas where yields of these crops are comparatively low.

For the four major sunflower-producing States, farmers received an average of 10.7 cents a pound on last year's crop (oil varieties). Based on an average yield of 1,383 pounds per acre, sunflowers earned nearly $148 an acre.

Although soybeans offered a higher U.S. average return per acre, each producer faced a different situation

Sunflowers compete just as well with soybeans because they have a shorter growing season and usually do better under drought conditions.

In the South, too, sunflower plantings have caught on rapidly as a result of cutbacks in cotton allotments several years ago.

Sunflowers have served not only as another cash crop for Southern farmers, but have also filled some slack in cottonseed mills left with excess crushing capacity.

Big increase in oil production

Sunflowers have blossomed so rapidly largely because of two breakthroughs which vastly improved oil production.

The first was the development in the 1960's of sunflower varieties with an oil content of over 40 percent, a one-third increase over previous varieties.

The second breakthorugh, which came in the 1970's, was the development of hybrid sunflowers, which boosted yields another 25 percent.

In 1977, the year U.S. farmers made a major shift from open-pollinated to hybrids, hybrids took over 90 percent of the planted area. And new hybrids in various stages of development promise even better disease and insect resistance, as well as higher oil content.

Higher oil content

Oilseed sunflowers yield over 40 percent oil, whereas soybeans yield about 18 percent. And on a per pound basis, the oil is more valuable than the meal.

As a consequence, sunflowers are grown primarily for their oil—which contributes roughly 75 percent of the crop's proportionate value, compared with 40 percent for soybean oil. And it is in oil markets where the sunflower stands to make its biggest gains in the future.

Exports are currently the major market for oilseed sunflowers, taking between 70 and 80 percent of the U.S. crop.

Domestic food use

However, domestic food use of sunflower oil is expected to expand now that there is a dependable supply of U.S. oilseed sunflowers available for crushing.

Sunflower oil is higher in polyunsaturates than corn oil and is much more stable than safflower oil. Thus, it has an edge over these two competitors for use in premium grade margarine and cooking and salad oils.

Sunflower oil's higher price tag currently bars it from making substantial inroads against soybean oil in the vegetable shortening and lower priced vegetable oil margarine markets.

However, blended sunflower/soybean oil products are already on the market in some parts of the country, and their use could grow in the years ahead.

So, instead of being rivals, the two oilseeds could eventually end up partners in many of the world's fats and oils markets.

[Based on the speech, "Competitive Position of New Oilseed Sunflowers with Soybeans," by Harry Doty, National Economics Division, presented at the World Soybean Research Conference No. II, March 26-29, 1979, Raleigh, N.C.]

Recent Publications

Single copies of the publications listed here are available free from *Farm Index,* Economics, Statistics, and Cooperatives Service, Rm. 482 GHI, 500 12th St., SW, U.S. Dept. of Agriculture, Washington, D.C. 20250. However, publications indicated by *(*)* may be obtained only by writing to the experiment station or university indicated. For addresses, see July and December issues of *Farm Index*. Publications marked with (#) may be purchased from NTIS, U.S. Dept. of Commerce, 5285 Port Royal Rd., Springfield, Va. 22161, at the price listed.

Changes in Food Expenditures by Income Group. Anthony E. Gallo, William T. Boehm, and Corinne LeBovit, National Economics Division. ESCS-57.

How food expenditures and income have changed for family income groups over a 12-year period is examined in this report. The data are from 1960-61 and 1972-73 Bureau of Labor Statistics Consumer Expenditure Surveys. Family income rose at each income level studied. But, the percentage of family income spent for food by the lowest income group rose slightly, while the proportion of income spent on food declined significantly for higher income groups.

World Cotton Production and Use: Projections for 1985 and 1990. Keith J. Collins, Robert B. Evans, and Robert D. Barry; Economics, Statistics, and Cooperatives Service and Foreign Agricultural Service. FAER-154.

A crucial issue for the world's cotton producers is whether the pause in the growth of the world cotton market since 1973/74 represents a fundamental departure from past trends that will continue or whether there will be a resumption of strong upward growth. From 1947/48 to 1973/74, world mill consumption of cotton rose from 29.4 to 62.3 million bales. For 1977/78, preliminary data set world mill consumption at 61 million bales.

Indices of Agricultural Production in Africa and the Near East, 1969-78. International Economics Division. SB-623.

Indices of agricultural production in foreign countries are prepared as part of a continuing assessment of the current agricultural situation abroad. The country indices are calculated by Laspeyre's base-weighted aggregative formula. They are constructed from production series given in thousands of metric tons. The time reference is the calendar year in which the bulk of the crop is harvested or, in some cases, notably coffee and cocoa beans, the marketing year beginning in the indicated calendar year.

Bibliography on the Economics of Fruit and Vegetable Production and Marketing, 1965-76. Joan Pearrow, National Economics Division. ESCS-50.

This bibliography lists research reports published between January 1, 1965, and June 30, 1976, on the economics of the production and marketing of fruits and vegetables. It includes references on costs, prices, grades, competition, market structure, projections, shipments, processing, and miscellaneous activities. References have been compiled from various land-grant institutions and from The National Bibliography of Agriculture.

Regional Manufacturing Employment Growth Patterns. M. F. Petrulis, Economic Development Division. RDRR-13.

Industrial job growth appears to favor nonmetro areas and those regions of the country outside the Northeast and Midwest. During 1967-73, nonmetro areas had an 11.3-percent increase in industrial employment, while metro-area jobs dropped 3.2 percent. Employment in nonmetro areas increased in 18 of 20 major manufacturing industries, while metro-area employment declined in 11 industries. In all, manufacturing employment grew 0.8 percent, or by more than 145,000 jobs.

Indices of Agricultural and Food Production in Europe and the U.S.S.R., Average 1961-65 and Annual 1969 through 1978. Economics, Statistics, and Cooperatives Service, SB-620.

Europe and the U.S.S.R. produce and consume a large share of the world's food and fiber. Assessment of the agricultural and food situation in these areas is basic to a knowledge of world production, consumption, and trade in food and fibers. The indices presented in this publication are a part of the continuing effort of the Economics, Statistics, and Cooperative Service to assess the world agricultural situation.

Economic Trends

[1] Ratio of index of prices received by farmers to index of prices paid, interest, taxes, and farm wage rates. [2] Beginning January 1978 for all urban consumers. [3] Revised to adapt to weighting structure and retail price indexes for domestically produced farm foods from the new Consumer Price Index for all urban consumers (CPI-U) published by the Bureau of Labor Statistics. [4] Annual and quarterly data are on a 50-State basis. [5] Annual rates seasonally adjusted first quarter. [6] Seasonally adjusted. [7] As of March 1, 1967. [8] As of February 1.

Source: USDA (Agricultural Prices, Foreign Agricultural Trade, and Farm Real Estate Market Developments); U.S. Dept of Commerce (Current Industrial Reports, Business News Reports, Monthly Retail Trade Report, and Survey of Current Business); and U.S. Dept. of Labor (The Labor Force, Wholesale Price Index, and Consumer Price Index).

Item	Unit or Base Period	1967	1978 Year	1978 May	1979 March	1979 April	1979 May
Prices:							
Prices received by farmers	1967=100	—	210	215	246	244	246
Crops	1967=100	—	203	212	214	212	220
Livestock and products	1967=100	—	216	217	274	272	269
Prices paid, interest, taxes, and wage rates	1967=100	—	219	219	243	246	247
Prices paid (living and production)	1967=100	—	212	212	235	237	239
Production items	1967=100	—	216	217	243	246	247
Ratio[1]	1967=100	—	96	96	101	99	100
Producer prices, all commodities	1967=100	—	209.3	208.0	226.4	229.7	231.6
Industrial commodities	1967=100	—	209.4	207.4	225.1	228.6	231.1
Farm products	1967=100	—	212.7	215.8	242.5	245.9	245.2
Processed foods and feeds	1967=100	—	202.6	202.4	220.4	222.3	222.1
Consumer price index, all items[2]	1967=100	—	195.4	193.3	209.1	211.5	214.1
Food[2]	1967=100	—	211.4	210.3	230.4	232.3	234.3
Farm Food Market Basket:[3]							
Retail cost	1967=100	—	199.4	198.8	220.7	222.4	224.2
Farm value	1967=100	—	207.4	212.1	242.1	240.7	235.8
Farm-retail spread	1967=100	—	194.5	190.6	207.7	211.3	217.1
Farmers' share of retail cost	Percent	—	39.3	40.3	41.4	40.9	39.7
Farm Income:[4]							
Volume of farm marketings	1967=100	—	—	—	111	103	—
Cash receipts from farm marketings	Million dollars	42,817	111,042	8,148	10,019	9,126	—
Crops	Million dollars	18,434	52,051	3,063	4,285	3,451	—
Livestock and products	Million dollars	24,383	58,991	5,085	5,734	5,675	—
Gross income[5]	Billion dollars	50.5	126.0	—	142.0	—	—
Farm production expenses[5]	Billion dollars	38.2	98.1	—	106.5	—	—
Net farm income[5]	Billion dollars	12.3	27.9	—	35.5	—	—
Agricultural Trade:							
Agricultural exports	Million dollars	6,380	29,407	2,729	2,877	2,651	2,509
Agricultural imports	Million dollars	4,452	14,804	1,277	1,389	1,480	1,375
Land Values:	Dollars						
Average value per acre		[7] 168	[8] 488	—	[8] 559	—	—
Total value of farm real estate	Billion dollars	[7] 189	[8] 512	—	[8] 584	—	—
Gross National Product:[5]	Billion dollars	796.3	2,107.6	—	2,267.3	—	—
Consumption	Billion dollars	490.4	1,340.1	—	1,440.4	—	—
Investment	Billion dollars	120.8	345.6	—	370.4	—	—
Government expenditures	Billion dollars	180.2	433.9	—	458.4	—	—
Net exports	Billion dollars	4.9	−12.0	—	−3.7	—	—
Income and Spending:[6]							
Personal income, annual rate	Billion dollars	626.6	1,708.0	1,682.1	1,855.8	1,863.3	1,876.5
Total retail sales, monthly rate	Billion dollars	24.4	65.0	64.3	72.0	71.2	71.1
Retail sales of food group, monthly rate	Billion dollars	5.8	14.3	14.3	15.6	15.8	15.8
Employment and Wages:[6]							
Total civilian employment	Millions	74.4	94.4	94.1	96.8	96.2	96.3
Agricultural	Millions	3.8	3.3	3.2	3.3	3.2	3.2
Rate of unemployment	Percent	3.8	6.0	6.1	5.7	5.8	5.8
Workweek in manufacturing	Hours	40.6	40.4	40.4	40.6	38.9	40.2
Hourly earnings in manufacturing, unadjusted	Dollars	2.83	6.17	6.02	6.55	6.54	6.62
Industrial Production:[6]	1967=100	—	145.2	143.9	152.3	150.2	152.1
Manufacturers' Shipments and Inventories:[6]							
Total shipments, monthly rate	Million dollars	46,487	125,317	123,566	143,796	135,987	—
Total inventories, book value end of month	Million dollars	84,527	197,802	187,689	205,393	208,679	—
Total new orders, monthly rate	Million dollars	47,062	129,263	128,450	150,215	141,090	—

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